Re-interpretation of Anglesey-Lleyn geotectonic framework in terms of the Pacific-type orogenic evolution

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The Mona Complex in Anglesey-Lleyn, Wales formed via Neoproterozoic-Ordovician subduction-accretion processes on the Avalonian margin. It consists of an ophiolite, high-pressure metamorphic rocks, volcaniclastic sediments, but comprehension of their tectonic evolution has been hindered by the paucity of age constraints. A major geochronological study is necessary to elucidate the subduction, accretion and exhumation history of the Avalonian orogen. Therefore, we have provided U-Pb zircon data for volcano-sedimentary rocks in the Monian Supergroup, and then K-Ar data of micas for pelitic and mafic schists in the Blueschist unit, the Central Shear Zone, and the New Harbour Group. By integrating with published data, our new chronological data enable re-interpretation of Anglesey-Lleyn geotectonic framework in terms of a younger analogue of comparable blueschist belts and accretionary orogens in Japan and California.

The early records of arc activities are widely distributed in Avalonia, and they date back to 760 Ma. The presence of 711–677 Ma calc-alkaline granites in Wales and Central England suggests that subduction of the Iapetus Oceanic plate already drove arc-related magmatism along the Avalonian margin. In the period of main arc magmatism (616–555 Ma), an accretionary complex with the Gwna Group sediments formed (by 578 Ma) on an active margin of Avalonia. Its formation likely continued to 530 Ma. Moreover, metamorphic rocks of the Blueschist unit and the Central Shear Zone were exhumed from different crustal depths in the interval 578–530 Ma. Afterwards, sediments of the New Harbour and South Stack Groups were deposited at < 515 ±13 Ma and < 501 ±10 Ma. The New Harbour and South Stack Groups were finally accreted underneath the Gwna Group at the base of the accretionary wedge. The greenschist facies metamorphism of the New Harbour Group at 474 Ma constrains its minimum depositional age. In a larger perspective, our new ages are broadly contemporaneous with the calc-alkaline continental arc magmatism in NW Wales and Central England that formed by successive eastward subduction from 711 to 474 Ma.

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